

## A New Genus of Indo-West Pacific Turridae (Gastropoda: Prosobranchia)

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**Abstract.** Based on specimens collected in the Gulf of Aden at bathyal depths and stored primarily in Museo di Zoologia dell'Università di Bologna, *Acanthodaphne sabellii*, gen. & sp. nov. is here described and figured. The Recent *Pleurotomella abbreviata* Schepman, 1913, from Ceram Sea, Indonesia, and *Puha pusula* Laws, 1947, from the Early Miocene of Hokianga, New Zealand, are recognized as belonging to the new genus. SEM photographs of type specimens of both previously known *Acanthodaphne* species are provided.

### INTRODUCTION

The examination of turrid samples collected by the Oceanographic ship MARION DUFRESNE, within the framework of the European Community project RED SED' 92 (Red Sea and Gulf of Aden), in the Gulf of Aden led us to recognise the empty shells of an unknown, distinctive raphitomine species. This species is undescribed and shares with the New Zealand Early Miocene (Otaian) *Puha pusula* Laws, 1947, and the Indonesian Recent *Pleurotomella abbreviata* Schepman, 1913, distinctive morphological features which can be used in recognition of a new supraspecific taxon here proposed as *Acanthodaphne*, gen. nov. *Acanthodaphne sabellii*, the new species from Gulf of Aden, is extremely similar to *Puha pusula* and examination of material relevant to this latter species proved to be necessary. The close resemblance between the new species and *P. pusula* indicates that shell characters in *Acanthodaphne* have remained remarkably stable over about 20 m.y.

Remarks and SEM photos based on the examination of the paratype of *Puha pusula* stored in Institute of Geological & Nuclear Sciences (New Zealand) are presented in order to define more precisely the differences between these two closely related species.

Although none of its members is anatomically known, *Acanthodaphne*, gen. nov. is here assigned to the subfamily Raphitominae Bellardi, 1875. The protoconch morphology and anal sinus shape of all species here assigned to the group are consistent with such attribution.

Under the cladistic classification of the superfamily Conoidea proposed by Taylor, Kantor & Sysoev (1993), the subfamily Raphitominae Bellardi, 1875 (synonym

Daphnellinae Casey, 1904), previously included in the family Turridae, is transferred to the Conidae. However, this proposed classification has recently been critiqued by Rosenberg (1998) who demonstrated that their results cannot be reproduced and remarked that additional data are necessary before a more complete classification can be performed. As we consider the assignment of the Raphitominae to the family Conidae at present uncertain, the traditional arrangement will be followed in the present paper, as well as in papers in progress, referring to Turridae *sensu lato*.

Abbreviations used in the text are: a/l = ratio of aperture length to total shell length; b/l = ratio of shell breadth to total length; IGZ = Institute of Geological & Nuclear Sciences, New Zealand; MNHN = Muséum National d'Histoire Naturelle, Paris; MZB = Museo di Zoologia dell'Università di Bologna; ZMA = Zoologisch Museum Amsterdam.

### SYSTEMATIC DESCRIPTION

Family TURRIDAE H. & A. Adams, 1853

Subfamily RAPHITOMINAE Bellardi, 1875

*Acanthodaphne* Bonfitto & Morassi, gen. nov.

Type species by original designation:

*Acanthodaphne sabellii*, sp. nov.

**Included species:** The type species (Gulf of Aden); *Pleurotomella abbreviata* Schepman, 1913 (Indonesia); *Puha pusula* Laws, 1947 (Early Miocene of New Zealand).

**Description:** Shell small (maximum length 8.5 mm), heavy and biconic. Whorls sharply angled below or near

middle, sculptured by opisthocline axial folds extending from lower suture to periphery where they form sharp tubercles. Spiral sculpture consisting of a peripheral cord with 1–2 weaker cords below it on spire whorls. Suture bordered by a subsutural fold bearing tubercles more numerous than axial folds. Subsutural ramp wide and weakly concave. Inner lip wide. In the type species, median area of the inner lip sometimes obliquely thickened but not producing a pleat. Fasciole well developed. Anal sinus moderately deep, reversed L-shaped. Protoconch multispiral with diagonally decussate riblets.

**Etymology:** From *Acanthus* (Latin name for the plant) referring to the solid shell with sharp tubercles somewhat reminiscent of the bold plant with stately spikes. Gender feminine.

**Discussion:** Laws (1947), in a work devoted to the study of the mollusca from Hokianga District, New Zealand, introduced the Early Miocene (Otaian) *Puha pusula* Laws, 1947. The species was subsequently listed by Powell (1966:131) as characteristic to the genus *Puha* Marwick, 1931, a taxon erected with *Puha fulgida* Marwick, 1931, an early or middle Miocene (Altonian-Clifdenian) species from Gisborne District, New Zealand, designated as type species.

Maxwell (1988) remarked that *Puha pusula* should be removed from the genus *Puha* and noted a close resemblance between the former species and the Recent Indonesian *Pleurotomella abbreviata* Schepman, 1913. Powell (1966) and Sysoev (1997) regarded *Pleurotomella abbreviata* as belonging to the genus *Cryptodaphne* Powell, 1942. Shuto (1971) transferred it with a query to genus *Buccinaria* Kittl, 1887. In the absence of a more appropriate generic taxon, Maxwell (1988) also provisionally referred *Puha pusula* to genus *Buccinaria*.

The new genus *Acanthodaphne* is here proposed for *Pleurotomella abbreviata* Schepman, 1913, *Puha pusula* Laws, 1947 and a third species, namely *Acanthodaphne sabellii*, sp. nov., from the Gulf of Aden. These three species constitute a peculiar species-group characterized by the small but heavy shell, biconic shape, tuberculate subsutural fold and sculpture of axial folds restricted to lower part of the whorl forming tubercles at periphery.

MacNeil (1960:110, pl. 5, fig. 13) reported and figured a *Pseudoinquisitor?* cf *P.?* *pulchra* known from a single specimen from Yonobaru Clay, Miocene of Okinawa (Japan). The author noted that the species “does not have any close relatives in the region of Japan.” Judging from the figure provided, it closely resembles members of *Acanthodaphne* in type of sculpture. Unfortunately, the protoconch features are unknown and the position of the species therefore remains indeterminate.

*Acanthodaphne* closely resembles the genus *Puha* Marwick, 1931, in some features such as the tuberculate subsutural fold and periphery. However, the former genus differs from the latter in shape (biconic compared to

ovate-elongate), smaller dimensions (5.6–8.5 mm compared to 9–12.4 mm in length), less gradate whorls with much broader subsutural ramp, and moderately deep reversed L-shaped anal sinus compared to virtually absent. Powell (1966:130) noted that in *Puha* “there is no anterior fasciole” whereas in *Acanthodaphne* it is well developed. Some specimens of *Acanthodaphne sabellii*, sp. nov. have an obliquely thickened inner lip. Marwick (1931:150) was probably referring to a similar feature when he described the inner lip of *Puha fulgida* as “grooved longitudinally near its raised outer edge.”

The Upper Oligocene to Recent genus *Cryptodaphne* Powell, 1942, may resemble *Acanthodaphne*, gen. nov. in having a biconic shell shape and a similar type of anal sinus. However, *Cryptodaphne pseudodrillia* Powell, 1942, type species of the genus, totally lacks axial folds with peripheral tubercles, possessing spiral keels and numerous, somewhat “*Tomopleura*-like” sigmoid threads over entire whorl surface. Shuto (1971) proposed *Acamptodaphne* Shuto, 1971, as a monotypic subgenus of *Cryptodaphne* Powell, 1942, with *Pleurotomella biconica* Schepman, 1913, selected as type species. In its biconic shape and distinct fasciole, *Cryptodaphne (Acamptodaphne) biconica* (Schepman, 1913) is superficially similar to *Acanthodaphne sabellii*, but differs in lacking a strong, tuberculate subsutural fold and in the weaker axial elements (Schepman, 1913, p. 444 referred to “rather inconspicuous axial ribs, nearly disappearing in last whorl”).

Both Schepman (1913) and Shuto (1971) referred to very coarse growth lines (“nearly rib-like”) occurring on the subsutural ramp of *C. (A.) biconica*. This feature is not noted in the species here assigned to *Acanthodaphne*. Also, *Acanthodaphne* species have fewer spiral elements. Shuto (1971) described and figured the anal sinus of *C. (A.) biconica* (Schepman, 1913) which, if correctly interpreted on the basis of the growth lines, differs from that of *Acanthodaphne* being deeper and differently shaped. Finally, the measurements available in literature (Schepman, 1913; Shuto, 1971) indicate that the type species of *Acamptodaphne* is narrower than any member of *Acanthodaphne* (b/l 0.41 compared to 0.47–0.55).

The new genus differs from the Miocene to Recent *Mioawateria* Vella, 1954, in possessing much stronger axial folds, less gradate whorls, broader subsutural ramp and in the moderately deep anal sinus compared to virtually absent (growth lines indicating at most a weak insinuation).

*Gymnobela* Verrill, 1884, as construed by Sysoev (1996, 1997) and Sysoev & Bouchet (2001), includes the species previously assigned to *Bathybela* Kobelt, 1905, *Speoides* Kuroda & Habe in Habe, 1962, and *Theta* Clarke, 1959, taxa retained at most as subgenera. In addition, Sysoev (1996) noted a certain resemblance between *Mioawateria* Vella, 1954, and *Gymnobela* Verrill, 1884, and stated that the former “may be either a large and very widely distributed genus or a synonym of *Gym-*

*nobela*." The same author (Sysoev, 1997) subsequently retained *Mioawateria* as a full genus and referred to it the West African *Gymnobela rhomboidea* Thiele, 1925.

*Acanthodaphne*, gen. nov., *Mioawateria* Vella, 1954, and *Puha* Marwick, 1931, possess a somewhat *Gymnobela*-like. These three genera are first reported in the early Miocene of New Zealand. Despite the large number of species included and the very wide distribution, we know of no *Gymnobela* species based on fossil material and the genus never occurred in the Cenozoic of New Zealand (Beu & Maxwell, 1990). Members of *Acanthodaphne*, *Mioawateria* and *Puha* are rather small compared to *Gymnobela* species, which usually exceed 20 mm and may reach 70 mm in length, and further differ from *Gymnobela* in details of sculpture and/or anal sinus. *Acanthodaphne*, for example, is readily distinguished from *Gymnobela* by the more biconic shell with well developed subsutural fold bearing tubercles, a feature not occurring in the latter genus which has at most thickened scars of the anal sinus. In addition, *Acanthodaphne* has a greatly reduced number of spiral sculptural elements on spire whorls, a developed fasciole and may possess an obliquely thickened inner lip.

Given the differences in morphology, geological occurrence and the most probably polyphyletic nature of *Gymnobela* as currently used in literature, we consider *Acanthodaphne*, *Mioawateria* and *Puha* worthy of full generic status.

*Acanthodaphne* may be compared to the Tertiary to Recent genus *Buccinaria* Kittl, 1887, but the former differs from the latter in dimensions (maximum length 8.5 mm vs. more than 20 mm of typical *Buccinaria* species), different shape (biconic shell vs. ovate-pyriform or buccinoid) and reduced spiral sculpture. Furthermore, in the new genus the anal sinus is moderately deep while in *Buccinaria* it is broader and shallower.

The New Zealand genus *Awateria* Suter, 1917, superficially resembles *Acanthodaphne* in having a well developed subsutural fold and axial sculpture. However, *Awateria* species have very different proportions (the spire is 1.5 times height of aperture and canal according to Powell, 1942, and Beu & Maxwell, 1990).

Powell (1942) regarded *Awateria* "closely allied" to the raphitomine genus *Gymnobela* but Beu & Maxwell (1990) assigned it to subfamily Borsoniinae (= Clathrellinae).

*Acanthodaphne sabellii* Bonfitto & Morassi,  
sp. nov.

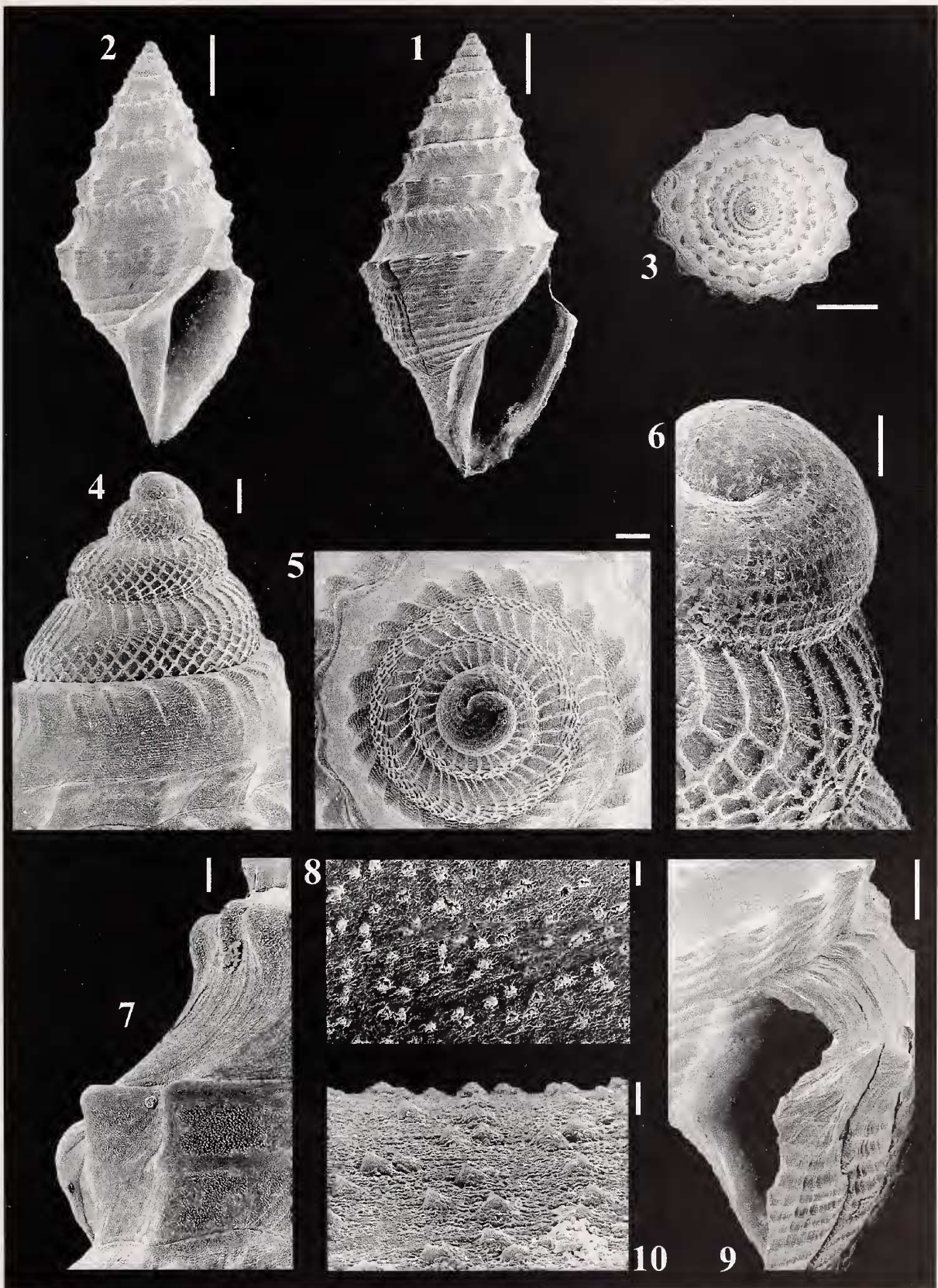
(Figures 1–10)

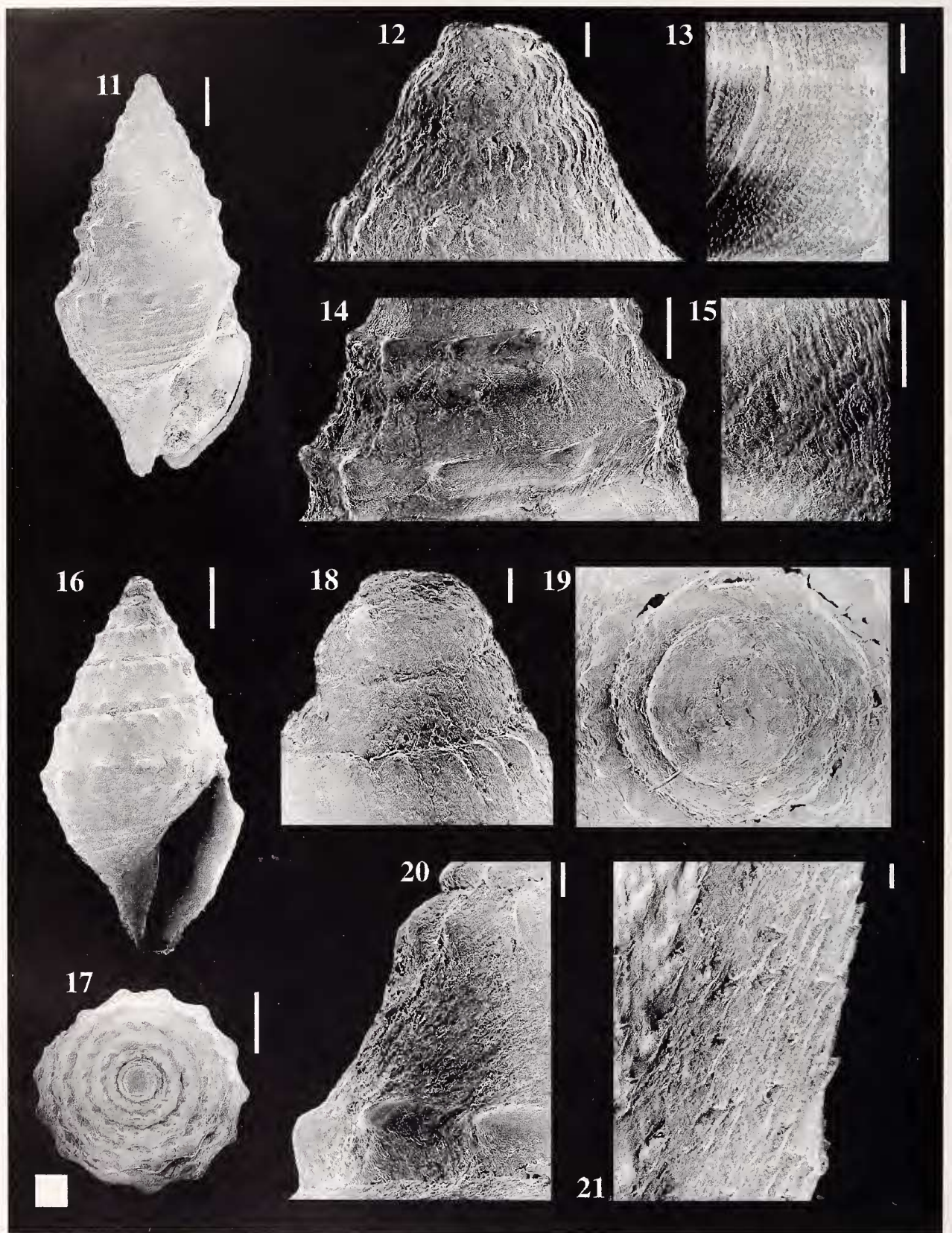
**Diagnosis:** *Acanthodaphne* with subsutural fold sculptured by somewhat comma-shaped tubercles about twice as numerous as folds. Last whorl with 14–16 axial folds extending across base but not onto neck. Maximum length 6.6 mm.

**Description:** Shell small (up to 6.6 mm in length), heavy and biconic. Teleoconch consisting of about 4.5 whorls which are sharply angled below middle on early whorls, near middle on later ones. Subsutural ramp wide and gently concave. Whorls separated by a weakly impressed suture margined by a subsutural fold. Sculpture consisting of short, narrow, opisthocline folds extending from shoulder angle, where they form prominent tubercles, to the lower suture on spire whorls and across base evanescent at level of the neck on the last whorl. Axial folds of rounded-triangular cross-section with interspaces wider than them. There are 12–15 axial folds on penultimate whorl, 14–16 on last. Subsutural fold sculptured by tubercles about twice as numerous as folds on later whorls. Spiral sculpture consisting of a narrow peripheral cord doubled during growth by a weaker cord anteriorly. In larger specimens, additional weak cord, just above lower suture, developed on later whorls. Last whorl with 2–3 threads in interspace between two main cords; below line of suture 2 cords present with 1 thread in each interspace, 3 widely spaced cords, and fine threads on the neck (10 in the holotype). Under SEM magnification (Figure 1H), entire whorl surface seen to be covered by dense rows of granules. Aperture pyriform. Inner lip wide, columella forming a distinct angle with parietal region. In some specimens, median area of inner lip obliquely thickened but not producing a pleat. Under SEM surface of inner lip seen to be covered with prickly nodules (Figure 1J). Siphonal canal short and shallowly notched. Outer lip without labral varix. Anal sinus moderately deep, reversed L-shaped. Color white with yellowish protoconch.

Protoconch conical, of up to 3.5 whorls, first half whorl (protoconch I stage) covered with minute spiral threads crossed by even finer axial threads giving a reticulate appearance; subsequent part (protoconch II stage) sculptured by opisthocyrt axial riblets extending from suture to suture decussate by oblique threads on anterior two-

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Figures 1–10. *Acanthodaphne sabellii* Bonfitto & Morassi, sp. nov. Figure 1. Holotype (MZB 40664); scale bar 1 mm. Figures 2–3. Paratype (MZB 40666) from RS92/1. Figures 4–6. Protoconch; scale bar 100  $\mu$ m. (MZB 40666). Figure 7. Teleoconch; scale bar 100  $\mu$ m. (MZB 40664). Figure 8. Microsculpture of the teleoconch; scale bar = 10  $\mu$ m. (MZB 40666). Figure 9. Anal sinus; scale bar = 500  $\mu$ m. (MZB 40664). Figure 10. Inner lip prickly nodules; scale bar = 10  $\mu$ m. (MZB 40666).





thirds of each whorl. Protoconch maximum diameter: 0.55–0.62 mm.

**Dimensions** (in mm): Holotype 6.5 × 3.3 mm (b/l 0.51), aperture height 3.1 mm (a/l 0.47); largest paratype: 6.6 × 3.3 mm (b/l 0.50), aperture height 3.2 mm (a/l 0.48).

The available material was found at the following two localities:

Station	Co-ordinates	Depth	No. specimens
RS92/1	From 11°55'95"N–44°22'70"E	810 m	3
	To 11°55'82"N–44°22'53"E	795 m	
RS92/2	From 12°02'36"N–44°29'53"E	1400 m	6
	To 12°02'46"N–44°30'82"E	1395 m	

**Type deposition:** Holotype MZB 40664 and four paratypes MZB 40665 from Gulf of Aden (RS92/2), 1 paratype MNHN, unnumbered, same data; 1 paratype MZB 40666 from Gulf of Aden (RS92/1), 1 paratype IGNS, unnumbered, same data, 1 paratype ZMA, unnumbered, same data.

**Type locality:** Gulf of Aden, station RS92/2.

**Etymology:** This species is named after Professor Bruno Sabelli of the University of Bologna in recognition of his support to our studies.

**Remarks:** *Acanthodaphne sabellii*, sp. nov. most closely resembles the larger (up to 6.6 mm vs. 7.4–8.5 mm in length) *A. pusula* (Laws, 1947), these two species differing in relatively minor characters. *Acanthodaphne sabellii* has the subsutural tubercles about twice as numerous as folds on later whorls while in the paratype of *A. pusula* the tubercles are fewer (on penultimate whorl there are 11 folds and 16 tubercles). With regard to the axial sculpture of the last whorl, *A. sabellii* has stronger folds with sharper crests extending across base (but not onto neck) while in *A. pusula* the axials are rapidly fading below the periphery. In addition, while in *A. pusula* the last whorl surface bears numerous fine axial threads (Figure 2E) this feature is not noted in the new species.

#### *Acanthodaphne pusula* (Laws, 1947)

(Figures 11–15)

*Puha pusula* Laws, 1947:539, pl. 55, fig. 7.

*Puha pusula* Laws, Powell, 1966:131.

*Buccinaria* (?) *pusula* (Laws), Maxwell, 1988:68.

*Buccinaria* (?) *pusula* (Laws), Beu & Maxwell, 1990:420.

**Type locality:** Sandstone with lenses of fine conglomerate and shell grit about ¼ mile below junction of Taita Stream and Waimamaku River, Hokianga Harbour area, Northland, New Zealand.

**Occurrence:** Known only from the early Miocene (Otaian) of Hokianga, North Island, New Zealand.

**Material examined:** The paratype stored in IGNS, n<sup>o</sup>. TM 1803.

**Remarks:** Laws (1947) described the holotype of this species, stored in Geology Department of University of Auckland, New Zealand (accession number not provided), as measuring 8.5 × 4 mm (b/l 0.47), with 14 axial folds on the penultimate whorl. The paratype is smaller 7.4 × 3.9 mm (b/l 0.53), aperture height 3.4 mm (a/l 0.46) with 11 folds on penultimate whorl. From the original figure (pl. 55, fig. 7), it would also seem that the holotype has a somewhat more prominent subsutural fold than the paratype. However, these differences appear minor and presumably taxonomically not significant. The protoconch (fig. 2B) is damaged in the paratype examined but clearly of planktotrophic type with raphitomine sculpture. Under SEM (fig. 2C), the whorl surface is seen to be covered by dense rows of granules as in *A. sabellii*. Fine axial threads are clearly visible on the last whorl (fig. 2E).

#### *Acanthodaphne abbreviata* (Schepman, 1913)

(Figures 16–21)

*Pleurotomella abbreviata* Schepman, 1913:83 (447), pl. 30, fig. 6.

*Cryptodaphne abbreviata* (Schepman), Powell, 1966:127.

*Cryptodaphne abbreviata* (Schepman), Syssoev, 1997:348.

*Buccinaria?* *abbreviata* (Schepman), Shuto, 1971:12, pl. 2, fig. 1–3.

**Type locality:** 835 m, blue mud, Ceram Sea, Indonesia, 02°40'S, 128°37.5'E.

**Material examined:** The syntype stored in ZMA collection number 3.13.088.

**Remarks:** Schepman (1913) originally described this species on the basis of two shells. Shuto (1971) provided descriptive remarks based on the examination of the type

Figures 11–15. *Acanthodaphne pusula* (Laws, 1947) (SEM photos from specimen uncoated). Figure 11. Paratype of *Puha pusula* Laws, 1947 (IGNZ TM 1803); scale bar = 1 mm. Figure 12. Protoconch; scale bar = 100 µm. Figure 13. Microsculpture of the teleoconch; scale bar = 100 µm. Figure 14. Teleoconch whorl; scale bar = 500 µm. Figure 15. Microsculpture of the body whorl; scale bar = 500 µm.

Figures 16–21. *Acanthodaphne abbreviata* (Schepman, 1913) (SEM photos from specimen uncoated). Figures 16–17. Syntype of *Pleurotomella abbreviata* Schepman, 1913 (ZMA 3.13.088); scale bar = 1 mm. Figures 18–19. Protoconch; scale bar = 100 µm. Figure 20. Teleoconch; scale bar = 100 µm. Figure 21. Inner lip prickly nodules; scale bar = 10 µm.

material. However, only one specimen of the original two is presently stored in Zoologisch Museum Amsterdam, the second (3.13.089) being lost. This specimen, which presumably is the one figured by Shuto (1971), measures  $5.6 \times 3.1$  mm (b/l 0.55), aperture height 2.9 mm (a/l 0.52) and has 14 axial folds on penultimate whorl. The protoconch (Figure 3C–D) is worn but clearly planktotrophic with traces of decussate riblets, and a maximum diameter of about 0.56 mm. The shell surface microgranulation occurring in both *A. sabellii* and *A. pusula* appears to be abraded in this specimen. However, the prickly nodules on the inner lip are evident (Figure 3F).

As stated above, Powell (1966), followed by Sysoev (1997), assigned the species to genus *Cryptodaphne* Powell, 1942 but did not provide elements supporting this attribution. We agree with Maxwell (1988:68) in considering *Pleurotomella abbreviata* very similar in supra-specific features to *Puha pusula*, these two taxa are accordingly here assigned to the new genus *Acanthodaphne*. However, *A. abbreviata* differs from its congeners in possessing the peripheral tubercles just above lower suture (Figure 3A–E) on all teleoconch whorls while in the two other *Acanthodaphne* species the periphery is near middle on later whorls.

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